

Feb. 25, 1936.

C. R. PATON

2,032,224

FAN

Filed Feb. 1, 1933

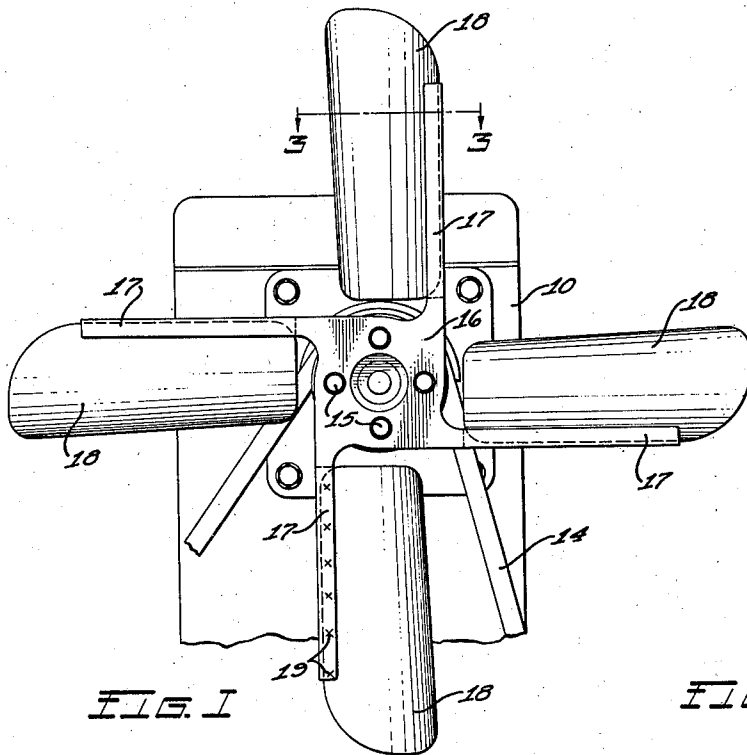


FIG. I

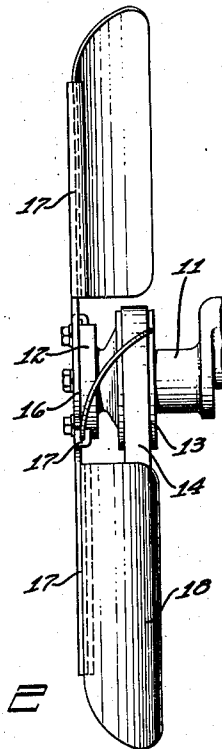


FIG. E

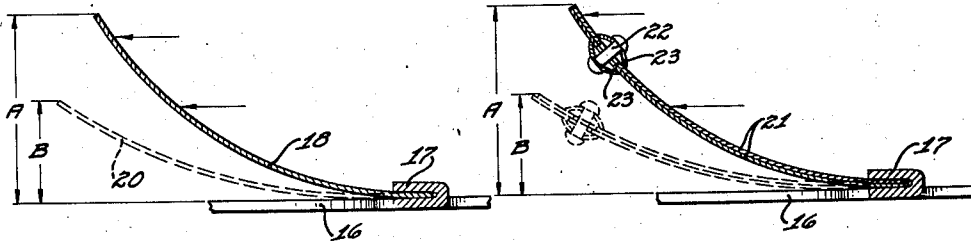


FIG. 3

FIG. 4

Inventor
CLYDE R. PATON.

By

Mullen-Sittels

Attorney

UNITED STATES PATENT OFFICE

2,032,224

FAN

Clyde E. Paton, Birmingham, Mich., assignor to
Packard Motor Car Company, Detroit, Mich.,
a corporation of Michigan

Application February 1, 1933, Serial No. 654,609

3 Claims. (Cl. 170—161)

This invention relates to fans and more particularly to fans employed with cooling systems for the power plant of motor vehicles.

As the fan for engine cooling systems is driven by the engine, its speed of rotation varies in accordance with the speed of the engine. Noise resulting from the fan operation also varies in accordance with the engine speed and, at higher speeds, is quite objectionable now that other parts of the vehicle are being quieted. The volume of air displaced by the fan per revolution does not vary much with speed so that a fan adequate for the cooling system at low operating speeds of the engine will be more than sufficient during fast movement of the vehicle and particularly during low temperature conditions. Because of the load imposed upon the fan at high speed operation, considerable driving belt trouble has been experienced due to slippage friction and the heat resulting from such friction, and for this reason the life of driving belts is materially shortened.

An object of the invention is to provide a fan which will displace a larger volume of air, per revolution, while operating at slow speeds than while operating at high speeds.

Another object of the invention is to provide a fan which will require less power for high speed rotation than for slow speed rotation.

A further object of the invention is to provide a cooling fan in which the blades automatically change form at higher operating speeds to decrease the air volume displacement so that noise is reduced and power required for operation in the higher speed range results.

Still another object of the invention is to provide a cooling fan in which the blade angle changes automatically with the speed of rotation to vary the air volume displaced, per revolution, inversely with the speed of fan rotation.

Other objects of the invention will appear from the following description taken in connection with the drawing, which forms a part of this specification, and in which:

Fig. 1 is a front elevational view of an engine having my improved form of cooling fan associated therewith;

Fig. 2 is a side elevational view of the fan associated with its bearing member;

Fig. 3 is a sectional view of one of the fan blades taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional view of a modified form of fan blade.

Referring now to the drawing, 10 represents the forward end of an internal combustion en-

gine adapted to be used as the power plant for driving a vehicle. Projecting from the front end of the engine is a bearing shaft 11 upon which the hub 12 of a fan is mounted to rotate. At one end of the hub is fixed a grooved pulley 13 with which is associated an endless driving belt 14 driven from a moving part of the engine.

Fixed to the fan hub, and preferably to the forward end thereof by means of bolts 15, is a spider 16 from which arms 17 extend radially. The spider and its arms provide means for fixing the fan blades 18 to the hub 12. The arms are each formed to provide a recess into which a side edge portion of the fan blades can be inserted, the blades being fixed in such relation by suitable means such as welding, as indicated at 19.

The blades are formed of thin flexible material, preferably metal, and curve from side to side. The blades are furthermore arranged to extend at an angle in the path of rotation.

As the speed of the fan increases, the pressure of air will flex or bend the blade in a direction as indicated by dotted lines at 20 in Fig. 3, thereby decreasing the degree of the angle with respect to the direction of rotation. The low speed or normal angle of the fan blade is indicated at A and the angle of the blade at higher speed is indicated at B in Fig. 3. It will be seen that, when the blade is in its high speed position, the angle will have decreased substantially one-half what it normally is, and thus volume of the air with which the fan blades contact during high speed rotation is considerably less than during slow speed rotation. For the same reason, there is less resistance to be overcome by the driving belt so that slipping and frictional heat is materially reduced at high speed over what they would be if the fan blade remained at the same angle throughout the different speeds of fan rotation. The flexible blade also permits the use of a fan to move a large volume when the engine is running slow, sufficient to take care of cooling under heavy duty conditions and, at high speeds, the volume of air which is moved by such fan will be considerably reduced so that the engine is not cooled too much under low temperature conditions or when the vehicle is moving at high speed. As the blade moves to positions decreasing its curvature, a smaller area of air is contacted by the fan so that the resulting noise is reduced.

In Fig. 4, I have shown another type of blade which can be employed and, in this instance, there are two sections of thin flexible material

as indicated at 21. These sections are of substantially the same form and are associated in aligned position with an edge secured in the recess of the arm 17, as previously described.

5 In order to prevent any fluttering caused by separation of the two sections of the blade, I provide means for frictionally holding them together at their free edge. Such means consists
10 of a rivet 22, which extends through a transversely extending slot in the blade sections and resilient friction elements 23 which are in the form of segments of a sphere arranged so that
15 the shank portion of the rivet extends through openings therein. These friction members engage the exterior surface of the two fan blade sections and are compressed thereagainst by their relation with the rivet. The friction means is free to move transversely of the blade during
20 flexing at different rotational speeds and, under all operating speeds, will maintain the laminations of the blade in frictional relation. This form of laminated blade serves the same function and operates in the same manner as the single blade shown in Fig. 3, and is another
25 form which the invention can take.

As shown in Figs. 3 and 4 which illustrate in dotted lines the positions of the parts when the fan is rotated at high speed, the relatively heavy arm of the spider to which one side edge of each
30 blade is attached holds this side edge from substantial flexing longitudinally during the rotation of the fan.

Through the formation of a fan blade, in the manner described, belt driving trouble and fan noise are materially reduced. In addition to these advantages, a fan of the type described herein can be designed to give adequate cooling
35 under low speed heavy duty without producing too great a cooling effect under high speed operation.
40

Although the invention has been described in connection with a specific embodiment, the principles involved are susceptible of numerous other applications which will readily occur to persons skilled in the art. The invention is therefore
5 to be limited only as indicated by the scope of the appended claims.

What I claim is:

1. A fan comprising a hub, a spider fixed to the hub, flexible laminated blades fixed along one
10 side to the spider, and resilient means associated with the free side of each of the blades holding the laminations in frictional contact.

2. A fan comprising a driven hub, a spider fixed to the hub and having arms extending radially in the same radial plane and transversely
15 curved blades each having one side edge fixed to one of the arms and held substantially from flexing longitudinally by said arm, said blades extending at all points at oblique angles to the
20 plane of hub rotation and in the same direction from said arms with respect to the direction of hub rotation and each flexing similarly sidewise throughout its length under air pressure to reduce its curvature at high speed operation.
25

3. In an internal combustion engine, a driven shaft, a spider extending transversely of and fixed to the shaft, the arms of said spider being in the same vertical plane, flexible blades curved
30 in cross section and each having one edge secured to one of the arms of the spider and held substantially from flexing longitudinally by said arm, said blades each extending rearwardly at all points from the secured edge at oblique angles
35 to the plane of hub rotation and flexing sidewise substantially uniformly along their entire length to vary their curvature inversely with the speed of the shaft.
40

CLYDE R. PATON. 40

CERTIFICATE OF CORRECTION.

Patent No. 2,032,224.

February 25, 1936

CLYDE R. PATON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 16, claim 2, for "radial" read vertical; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of May, A. D. 1936.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)